FORESTS AND WATER SUPPLY.

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NATURAL REPRODUCTION OF FORESTS

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ARIZONA FOREST RESERVES

IN THE WOODS OF MINNESOTA.

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A Typical Forest Scene in Western Washington.

THE FORESTER.

VOL. V. NOVEMBER, 1899. NO. 11.

Effect of Forests on Water Supply.

Being a Paper Read at the Summer Meeting, Los Angeles, Cal., 1899.

I.—INVESTIGATIONS REGARDING RAINFALL AND PERCOLATION AS RELATING TO WATER SUPPLY THROUGH FOREST INFLUENCES.

The waters of the earth derive their existence from the heavens above and have no other source. This is the fundamental principle underlying all discussions on water-supply. There is no spontaneous process of production, no water manufactory in the recesses of the earth, no source but the clouds.

Forests interpose between earth and sky and become factors in the engineering problems of water-supply. Their action is in the direction of increasing precipitation, decreasing evaporation, and modifying floods. It is proposed in this paper to review some of the more salient relations between forests and water.

Many meteorological stations in connection with forestry have been established in France, in Germany, in India and elsewhere. In this country the subject has also received attention, but on a more limited scale. It is an unfortunate fact in regard to all subjects connected with rainfall that systematic observations must have been conducted over a long series of years—at least thirty-five—in order to obtain data upon which to predicate positive results.

The records of a few years may be, and frequently are, very misleading. The secular meteorological changes tend to move in cycles of wet periods and drouth. No conclusions can safely be accepted that are not based on records extending sufficiently back into the past to embrace and give full weight to these cycles.

The records of precipitation at Philadelphia extend back to 1825. Charting the precipitations gives a wave-like curve descending very low in 1825 but with its sinuosities all well above that point until 1881, when the minimum precipitation of 1825 was again closely approached. The period of extreme low precipitation was fifty-six years. The years of maximum precipitation were 1841 and 1867, the period being twenty-six years.

Taking the total of sixty-four years and averaging the annual rainfall by periods of four, eight, sixteen and thirty-two years we get the following results: The averages by four years run from 22 per cent. low, to 19 per cent. high—as compared with the average for the entire period of sixty-four years. The eight-year groupings gave results from 11 per cent. low, to 11 per cent. high—and the thirty-two-year—2 per cent. low, to 2 per cent. high.

Analyzing the recorded rainfall at Los Angeles for the past twenty-seven years and averaging by periods of five years gives results ranging from 35 per cent. below to 16 per cent. above the average seasonal rainfall for the entire period of twenty-seven years. The extreme low points of the Los Angeles precipitation curve are twenty-two years apart, being from the season of 1876–77 to 1898–99.

The fluctuations to which the average annual rainfall is subject have been very exhaustively discussed by Mr. Binnie, M. Inst. C.E., in a paper read before the Institution of Civil Engineers, London, in 1892.

From close analysis of records, of forty-two stations in various parts of the world, covering periods of from fifty to ninety-seven years, he drew the following conclusions:

That for records of five years the probable error in averages ranged from minus 16 per cent. to plus $17\frac{6}{10}$ per cent., the limits of error decreasing to minus 2 per cent. and plus 2 per cent. for periods of 30 years and over. And that the least number of years the continuous records of which would give an average annual fall that would not be materially altered by extending the record, would be thirty-five years. He also concluded that dependence could be placed on any good record of that duration to give an average rainfall correct within two per cent.

These examples will serve to illustrate the uncertainty attached to any deductions based on rainfall records of short duration. As a case directly to the point we have certain French observations made about sixty miles south of Paris. The observations for one year gave the precipitation over woods as 33 per cent. in excess of that over open ground. Three years continuous observations changed this to 2 per cent.

Long records for forest purposes are rare. The necessity for long records is but one of the many obstacles in the way of arriving at absolute comparisons between precipitation over woods and open grounds. Even after sufficient time shall have elapsed to reduce this particular trouble to a minimum, there will still remain the errors inherent to measuring rainfall and the difficulty of obtaining two locations, the one wooded and the other bare, whose conditions are absolutely comparable.

Rain-gauges are not instruments of precision, yet no conclusions can be more accurate than the data upon which they are based. The gauges record all that falls within them, but, except in still weather and with gentle rains, they do not intercept all that they should. Some very interesting and instructive data upon this subject has been published by the U. S. Department of Agriculture. It is shown that with the common unprotected gauge very large errors sometimes occur. It has also been shown that the decrease in catch of gauges raised above the ground formerly believed to have been due to height, is in reality due to increased freedom of wind action.

There is also another and perhaps even greater element of uncertainty attendant upon rain-gauging, viz.: The smallness of the actual collecting area of a gauge and the comparative immensity of the area of the country to which its readings are applied. With a ten-inch gauge to every four square (and this is a distribution far above the average), the ratio of area would be as about 200,000,000 to 1. At Rothamsted, in England, there is a rain gauge with an area of one thousandth of an acre. The catch on this gauge from 1853 to 1880 was about nine and eight-tenth per cent. more than the catch in an adjacent five-inch gauge. The ratio of their respective catchment areas is as 320 to 1. Now, if this ratio of area gave a variation of nearly ten per cent., we must not rely too implicitly on the results shown by applying the readings of a gauge to an area of country several hundred millions times the area of the gauge. The rain-gauge is an invaluable instrument, but to fully profit by its readings we must recognize, as with other instruments, its limitations and surroundings.

All these various difficulties considered, we are not warranted in hoping for any decisive direct quantitative comparison between the rainfall over wooded and open grounds similarly situated and exposed. However, while lacking in direct proof of this point, we do not know from the records of the various forest stations that woods reduce temperature and increase the humidity of the air, and, therefore, must to some extent increase precipitation.

The efficiency of foliage in mechanically arresting and condensing moisture is well known. If there are doubts, a walk

through underbrush on a misty morning will carry conviction to the most sceptical. A notable instance of the economic value of this feature of vegetation is to be seen at Ascension—a place that I visited in 1879.

It is a volcanic island lying a few degrees south of the equator and about midway between Africa and South America. It has an area of 30 to 40 square miles and is used as a naval station by the British Government. The water supply is obtained from near the summit of Green Mountain, so named from the fact of its being about the only green spot visible on the island. The summit elevation is about 2,800 feet above the sea, and its green cap of vegetation is maintained by the almost constant drip from trees and rocks of the moisture mechanically collected from clouds and fogs, eked out by light passing showers.

That the drip from trees should play so prominent a part in a domestic water supply is very satisfactory testimony to the efficiency of woods in mechanically increasing precipitation. Interesting experiments have been made as to the amount of condensation of aqueous vapor by leaves, but it does not appear that the velocity, if any, of the surrounding air was taken into account.

Cloud or fog is a manifestation of water in suspension, and it is obvious that the more rapidly the cloud is moved against any surface the more water will be brought into contact with that surface in a given time and the more it will collect. Unless condensation tests are conducted with reference to air velocity they will not furnish complete values. As before said, it is questionable whether a numerical value can ever be satisfactorily established for the action of forests in a direct increase of rainfall, but it is without question that their effect is in that direction—the point of uncertainty being one of quantity only.

In the matter of conserving of the water that has fallen, forests are important factors. They intercept the sun and rain, saving the earth from packing hard under the baking of the one and the persistent beating of the other. They appreciably decrease the quantity that would otherwise pass rapidly off into the runs and waterways and be lost in floods. Not only do they lessen the wasteful and destructive expenditure of water in floods, but they afford greater time for the earth to absorb to its full capacity the water held back by the mechanical obstructions of the forest floor. They also reduce the quantity lost by evaporation.

These things we enter on the credit side of the forest account with water supply, and on the debit side make the sole entry of the water used in supporting plant life. It remains to ascribe values to these various items and strike a balance.

All permanent water-supplies are drawn directly or indirectly from the rainfall absorbed and stored within the earth. Directly by the means of wells, tunnels, infiltration galleries and similar structures; indirectly through the medium of running surface streams, which in turn draw their supply from visible springs and the unseen accretions that enter along their beds from groundwater at high elevation.

The surface water which flows into the streams after rains gives but a temporary and passing supply. The permanent flow comes from ground storage. It must not be thought from this that all ground-water reappears at some time or other in the surface streams. Much passes on unseen to the sea. Its place of discharge into the ocean is at times well marked.

Off the east coast of England there is a sub-marine valley, called the Silver Pit, 20 miles long by from 50 to 250 feet deep below the general surface of the adjacent ocean bed. The extraordinary depth precludes it being due to currents, and from the circumstance of the depression occupying, as it were, the focus of the concave chalk formation of eastern England it is held to be the place at which the inland groundwaters are discharged through the chalk.

Coming right home we have a discharge of oil into a sub-marine valley of great depth off Redondo, indicating a probable discharge from the inland oil fields. The direction of these under-ground flows is at times difficult to trace. Latham, the noted sanitary engineer, in some of his sewage

investigations found the ground-water of a valley passing partly straight down the valley in conformity with the surface configuration and partly turning more or less abruptly and passing under the hills and coming out on the further slope.

The capacity of the earth to receive and convey water is all-important to us. Whatever agencies give the rain freer access to the earth should be well studied. The condition of the ground-surface is of vital importance and it is here that forests exercise one of their most beneficent functions—a quality which in itself is more than sufficient to justify our constant efforts in preserving and extending our wooded areas.

All soils are dependent upon their top surface as to whether they absorb water or not. Take an extreme case: sand covered by an asphalt pavement, a great capacity for water but no mouth to take it in. Take an ordinary case, as exemplified by tests made at Colby, Kansas, by the U. S. Department of Agriculture. Comparative measurements of the moisture in soil were made at a depth of twelve inches under three separate conditions: First, a covering of natural prairie sod; secondly, bare soil, top cultivated; third, bare soil, sub-cultivated. The tests were continued daily throughout the months of June, July, August and September. Throughout the tests the cultivated soils showed over twice the moisture in the soil under the natural prairie top.

It has been suggested that the chief cause of the difference may have been due to the water taken up and evaporated by the grasses. A study of the record at times of rainfall, when there could have been no evaporation to speak of, does not, however, support any such assumption. In fact it is of interest to note that evaporation from plants which derive their water supply from the capillaries of the soil does not necessarily reduce the moisture of that soil at any time; that depends upon whether the sub-water is ample to keep up the demands of the capillaries. If the supply is good, a pipe does not show less water because the faucet at the end is open.

The percolation gauges at Rothamsted, the place previously spoken of, gave as an average for 20 years that 47½ per cent. of the total rainfall percolated through 20 inches of soil and 44.9 per cent. through 60 inches. The surface of the soil was kept clear of vegetation.

The capacity of sand for receiving and transmitting water can be well illustrated by the water supply of The Hague, capital of the Netherlands. The city is situated about two miles inland from the North Sea and has a population of 190,000. Its domestic water-supply is drawn from a tract of uncultivated country lying near the sea and covered with sand dunes, similar to portions of the New Jersey coast. The sand is described as very pure and white. The water is fresh to a depth of 66 feet below the sea. It is gathered by infiltration pipes and pumped to its destination.

Through the courtesy of Mr. Corey, the United States Consul at Amsterdam, I am able to give the percentage of percolating water as about 40 per cent. of the rainfall. According to other information, from 30 to 50 per cent. of the rainfall can be collected, the variation being according to the season of the year. In summer a loss is stated to take place by reason of vegetation. This draws attention to the point that whether vegetation aids ground storage or not depends largely upon the nature of the soil. In the case of sand, such as described, it is detrimental inasmuch as it impedes penetration and aids the extraction of moisture.

The water conductivity and capacity of various soils have received much attention at the hands of forest experimenters. By conductivity is meant the capacity to transmit water, and by capacity the quantity that a given volume of soil can be caused to receive into its interstitial spaces, generally spoken of as its voids. Of the quantity that can be thus introduced into dry soil, part can be removed only by processes of evaporation. It is held within the capillaries and as films around the grains, and will not yield to gravitation. The texture of the soil is the governing factor in rate of conductivity. It ranges from well-rounded pebbles through the gradations of sand and loam to clay. It requires

no mental effort to realize that conductivity is a very important element in storm run-off, and the yield of a ground-storage.

It is to be regretted that the literature of the subject is scant and unsatisfactory. The greater number of the records of tests that I have been able to collate are based on experiments with downward filtration. This is a very unsatisfactory method of determining the lineal speed of percolation, the ingoing water is always in conflict with the displaced air, and the results are vitiated. In my own tests I always use horizontal percolation with free top surface or upward percolation. Either method gives very uniform results.

H. HAWGOOD,
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(To be continued.)

Natural Reproduction of Forests on Old Fields in Eastern Kentucky.

Being a Paper Read at the Special Meeting, Columbus, Ohio, 1899.

Among the different phases of forestry that I have studied in this region, I have chosen this upon which to present a few observations because I feel that it touches a subject of first importance in American Forestry.

The vital question in forestry is, when a tree falls will another take its place? So much of formerly timbered land is demanded for agriculture that the answer must be no a great many times. And yet if we are to have trees in the future the "tall Oaks" must "from little acorns grow," and the conditions under which they are to grow must constitute the foundation of all forestry.

While in restricted areas, as on the treeless prairies, and on small tracts in older and more highly developed regions of the country, seed-sowing and hand-planting may be resorted to, yet till forestry is a much older science than it is in our country, and forest products have greatly increased in prices, the great majority of young trees must come by reproduction under natural conditions.

I can hardly present to you the conditions prevailing in the Berea region without reference to the geology of the country. Leaving the Ohio River at Cincinnati we pass southward through a horse-foot shaped area, the famous Blue Grass region underlaid with Silurian limestone. Bordering this, as though constituting the shoe, is a narrow exposure of Devonian consisting for the most part of black bituminous shales, exceedingly poor soil-making material. The beds lying over and outside of this are clays and fine sandy shales representing a great silting period in the sub-carboniferous. The erosion of these has largely formed the yellow clay soil that overlies the Devonian shales, giving the "flat lands" glades and shashes which are characteristic of this horse-shoe strip of country. These lands are "tight" in the vernacular of the region, becoming saturated with water during the rainy Winters and holding it till late in the Spring. In the hot, dry periods of Summer they dry out and bake like brick.

Above the shales, in the sub-carboniferous, we have a layer of fine-grained gray and buff sandstones which cause a bench to extend all around the hills at this level. This is succeeded by the massive mountain limestone, twenty to fifty feet in thickness, capped by the millstone grit of about the same exposure.

It is to the readily eroded character of the shales at the base and the resistant nature of the limestone and more especially of the conglomerate at the top, that we owe the peculiar and picturesque topography of the region. Bold, outstanding, flat-topped "knobs" with broadly spread-

ing bases, long lines of precipitous cliffs, deep, narrow valleys, darkly shaded coves and hollows, "rock-houses," abrupt "pinnacles," and "rock-castles" fairly startle the traveller at every turn. Above all this stretches away the level plateau of the coal-measures, but gashed and furrowed on all sides by the ragged valleys leading to the lower level. A difference in altitude of five or six hundred feet in half a mile is no unusual thing. The resulting character of the roads and their effect on the price of lumber and farm crops, not to mention the effect on social life and education, I leave to your imagination. As climate has everything to do with reproduction and growth of trees, this must not escape mention.

This is a region of abundant rainfall, the precipitation being from forty to fifty inches annually. Four months, from December to the first of April, amount almost to a rainy period. While occasional extremes of cold, when the mercury registers from 20 to 25 degrees occur, weather above the freezing point is the rule, so that the Winters are a succession of drizzling rains, mild freezes, wet snows, thaws and bright weather. A period of considerable dryness may be looked for from some time from June to September, though very heavy rainfalls may occur in that time.

I have been thus particular in describing the year's climate because it is to the generally wet, open character of the Winters that I attribute the prolific growth of seedling trees of a great number of varieties.

Where acorns will germinate uncovered on the surface of a compact clay soil, the conditions as to moisture and temperature may be considered good.

The lower Devonian and border Silurian lands were originally covered with a dense growth of the different Black Oaks, some White Oak, Black and Sweet Gum, Cherry, Sassafras of great size, Scarlet Maple and other species. On higher ridges more White Oak was found, some Chestnut, many Hickories of several species, large numbers of Pine, a mixture of *P. virginiana*, or Jersey Scrub Pine, but here a tree often seventy-five feet high and two feet in diameter with *P. echinata*, the short Yellow Pine of the western States.

The most valuable of this growth has been cut out and sawed, but much still remains. In the valleys among the hills, on the benches and in the heads of the rich coves is found a mixed hardwood growth of great value. White Chinquapin, Red and Black Oak, four species of Hickory, Beech, Soft and Sugar Maple, Buckeye, Basswood and Ash grow to fine size and unusual height, the density of the growth and the steepness of the slope both forcing them up in search of light. Higher up, above the grit-rock, lie the ridges clothed with the Chestnut and its close associate, the Chestnut Oak or Tanbark, *Quercus prinus*.

What I shall call Old Field No. 1 lies one-and-one-half miles southeast of Berea. The soil is a compact yellow clay over black Devonian shale. The surrounding growth is the usual mixture of these lands —the Black, Scarlet and Spanish Oaks, some White Oak, Hickories of four species, Soft Maple, Gum and two species of Pine. The field is about fifty rods long by thirty rods wide. It had been cultivated a good many years, how long I could not learn, and was turned out "about fifteen years ago," but was not pastured, as is so often the case.

The stand of young Pines upon this is complete, excepting a short distance on the washed banks of a little draw. The growth is almost wholly *Pinus virginiana*, or the "Black Pine," the local name, with a slight mixture, not 10% of *Pinus echinata*, or Yellow Pine. There are also a few Oaks, Hickories and such, but their number is insignificant.

An average specimen of Black Pine was cut as close to the ground as possible and was found to show twelve rings of growth and to be four and one-half inches in diameter. This was twenty-seven feet high, was clearing itself of branches for a few feet only, many dead ones still adhering to the tree.

An average specimen of Yellow Pine gave practically the same dimensions, but was straighter and cleaner in trunk, being clear of branches for half its length. What the growth was surrounding this

field fifteen years ago I cannot state accurately, but it could not have been very different from that at present, and now the Yellow Pines that might have seeded the field are fully as numerous as the Black. The greater vitality of the Black Pine seed and seedlings is strongly evinced here, as it is along roadsides and in pastures all over the country.

Field No. 2 is near the foot of the hills but still on the yellow clay soil. It is a rounding knoll of about two acres and was a part of one of the oldest fields in the region, having been abandoned about forty years. Here again there has been a complete stand of Pine, though they have been cut for house logs till in places the cover is a good deal broken. The stand is about one to every eight feet square on the average, which admits too much light. An average specimen of *Pinus virginiana* was cut and found to be 9½ inches in diameter at two feet and sixty and one-half feet high, showing thirty-eight rings in the stump. Six inches of the diameter growth had been made in the first ten years. The trunks of these and others were slightly crooked and was cleared of limbs more than six feet, the recently dead branches remaining to form ugly knots for thirty feet above. Trees of a foot or over in diameter had been cut here.

A small mixture of Yellow Pine in the grove gives opportunity for comparison. While there are not more than one per cent. of them the owner assures me that there has been a much larger proportion but they have died and fallen down. Those remaining show evidence that in many cases the Black Pines are overtopping them, and the fact that in all cases they have cleared themselves of branches perfectly to more than half their height shows that they will not endure shade as well as the Black Pine. The leader on Yellow Pine in early Spring is stouter, the branches are also stouter and stiffer, so that the tender growth is not bent about as much by the winds. This fact gives rise to much clearer and straighter bodies in the young timber. The difference is much that between Scotch and Austrian Pines when grown together.

A sample specimen of Yellow Pine cut was 8½ inches in diameter, 59½ feet high and showed 37 rings of growth at two feet. The growth was more evenly distributed throughout the period and a comparison between old trees would lead me to think that this will continue to make a steady gain for a longer time than the Black Pine and remain a sounder tree.

Field No. 3 lies up the hollow directly above No. 2 and has about the same history, save that when abandoned for cultivation it was pastured. Instead of a full stand of trees they are in groups and patches or singly on the lower ground and are heavier bodied, short and broad-topped except in the center of a considerable group. In such conditions, even, it is to be noticed that the Yellow Pine has formed a clean trunk for a considerable distance, and young trees seem often to do this under their own cover only.

Higher up on the sides of this hollow, where the cattle did not care to range, the stand of Pine is full, both species about equally represented. Many trees are ten to twelve inches in diameter and fairly on the way to make good saw-logs. Here again the Yellow Pine is much the best cleared of branches and presents straighter and cleaner trunks.

Field No. 4 is about 20 miles southwest of Berea, near the little station of Gun Sulphur. The location is a rather thin clay and gravel soil on the top of the bluff above the limestone. The millstone grit in this section is pretty well thinned out. This field was cleared 20 years ago and put in corn for two years, then abandoned. The growth is wholly Black Pine and perfectly dense, so that one can scarcely find his way through. The average height is about 20 feet and the diameter 3 inches.

Similar examples of reproduction of Pines could be multiplied indefinitely but these are good types. The Yellow Pine possesses much more value as a timber tree, and follows the more sandy ridges. The Black Pine, known to most of you as the Jersey or Scrub Pine, reaches a size to make profitable saw logs in this region, a character which I think it does not possess elsewhere. Its range is the wet flat-lands

rather than the drier ridges where the Yellow Pine is most abundant. In places where the two are associated the Black Pine will take the land to the exclusion of the better tree and forms dense thickets in all open places where it can find space sufficiently light and not too much trampled. It does not seem in the least disturbed by the severe droughts and heat to which it is often subject in July and August. It will endure almost as much shade as a Cedar.

Field No. 5 lies at the foot of the high peak near Berea, known as Bear Knob. It was a long time in cultivation, contained an orchard, a few relics of which still remain and was last tilled in '56 or '57, the owner being able to locate the date approximately by its relation to family affairs.

Here the predominating growth is hard wood, though some fine pines are mingled with this. The growth is dense, the young trees reaching up fifty to seventy feet high with clean, straight trunks cleared of branches for 20 to 30 and even 40 feet. Many of the trees are beginning to form crowns, others are still in the pole stage of growth. The cover is almost perfect. The species represented are, first, the Black and Falcate Oaks, some of which are a foot in diameter; White Oaks are next in number and are the most beautifully proportioned young trees of the species I have ever seen, with slender bodies, as clean as telegraph poles, six to eight inches in diameter. I shall study with interest to see whether they will be able to hold their supremacy in height with the Black Oak tribe. Hickories of the Shell-bark and Pig-nut species are six inches to ten inches in diameter and in the hands of a less conservative owner would have been sacrificed to the spoke trade before now. On the lower end of this field where a few decrepit Poplars (*Liriodendron*) have furnished the seed to be blown a hundred yards, we find a dense, shapely growth of this most valuable Southern tree.

What I shall call Field No. 6 is of a very different character from the preceding. This is a piece of "cove" land, being a widened-out, ampitheater-like head of a narrow valley and lying just above the mountain limestone, but passing the millstone-grit and heading in the sandy shales of the coal measures. Its sides are so steep that it was "tended" when in cultivation on the contour plan, *i. e.*, around the cove on a level. A wagon would hardly venture into it, produce and timber being removed on the low one-horse "slides," or sledges peculiar to the country. This field was one of the first opened in the region, over fifty years ago, and the last crop of corn was raised on it in 1864. It is entirely covered with a thrifty timber, the cover in most parts being perfect, though somewhat thin in others from the cutting out of the new growth for various purposes. I am assured that it was a clean field when the last crop was raised, the present growth being wholly from the seed since 1864. Of the taller trees over half are of "Poplar," so-called in the South, the White-wood of the northern markets, *Liriodendron tulipifera*.

If the White Pine is the queen of the northern forests, certainly the Poplar ranks as queen of the southern, and at the rate the old growth is disappearing, we must hail with satisfaction the appearance of a new growth under conditions which indicate that it is readily reproduced. In the better part of the field, in a hollow with a northern and northwestern exposure, these beautiful young trees tower up from fifty to eighty feet, with clean, smooth trunks as round as columns. Already a good many of them a foot in diameter and over have been cut out to make house logs. The best remaining specimen I cut and sectioned every eight feet for study. At a foot high it was seventeen inches in diameter and showed thirty-three rings, which would indicate an age of thirty-four or thirty-five years. The ground must have seeded in at once on the turning out of the field and the seed must have blown from old trees two hundred yards away.

Hickory of two species, from six to nine inches in diameter and forty to fifty feet high, were in the field, while better ones had been cut to make spoke stock. A large number of Black Locust had been cut for posts, the trees being five to eight inches in diameter, so that scarcely representative specimens were left standing.

This last field is only one of many of similar character, though many of them when cultivation ceases are pastured, which invariably results in an imperfect cover and poor quality of body growth. Dogwood and Redbud are the common under-growth. Often grapevines get in and become a great detriment.

The fact that by the time the young trees have reached this age the owners often think the timber rotation of sufficient length and clear the land again, prevents, in a good many instances, these young forests from growing to a profitable age. The lessons from them, however, are full of significance and encouragement for those who would take such tracts in hand for forest purposes.

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Second Growth Pine vs. Agriculture.

Some Views on the Desirability of Crops Under Varied Conditions.

In discussing problems of forest policy, sufficient account is not always taken of the varying needs of localities with regard to maintaining forest areas. Often the matter is treated as if the preservation of forests everywhere and under all conditions were a desirable thing. Thereby local antagonism is aroused and desirable legislative measures prevented.

I wish to discuss briefly the question of to what extent it is desirable that forests be maintained in those portions of Michigan, Wisconsin and Minnesota, into which agricultural settlers are now actively going. As everybody knows, these regions have heretofore been the chief seats of the White Pine industry. Everybody also knows that from large portions of this area the mercantile Pine has disappeared, and that in most of this territory soft wood lumbering on a large scale will have come to an end in about ten years. The people of the region all appreciate this and are generally looking towards agriculture to replace lumbering as their principal means of subsistence. The question now is: Will it be most advantageous to them to continue this attribute; or would it be wiser to adopt such measures as will establish, by the side of agriculture, a series of industries based upon raw material obtained from local forests.

It should be stated at the very beginning of such an inquiry, that this question will be settled with sole reference to the wishes of the local population. It may well be that it would be for the benefit of the nation if these tracts were set apart exclusively for the purpose of raising White Pine timber. But assuredly such will not be the case. The land in this region is nearly all in private hands, except only the northern part of Minnesota. So there can be no question of establishing a national forest reserve, either in Michigan or Wisconsin. There are in the latter two states no very large tracts into which the agricultural settler has not already made his entrance. Railways are traversing the region in all directions, towns and villages are numerous and growing. The time has long gone by for imposing upon these territories a policy not desired by them.

In order to bring about any sort of legislation tending to keep a considerable amount of land under forest, it is necessary, therefore, to convince the local residents that it is for their own interest to do so. At present they are very doubtful as to this. A proposition that forests are to be maintained by public authority, meets with the objections that this would keep the country from developing, and that the country needs the taxes to be derived from these lands if owned by private parties. The lands denuded of their timber growth are rapidly falling into the hands of specu-

lators who endeavor to sell them to agricultural settlers. That they are meeting with considerable success in this direction is undoubted. Although much of this sort of land is unquestionably unfit for agriculture it is extremely difficult to say just which is and which is not, as no detailed survey of the region has ever been made. Some sort of agriculture can undoubtedly be carried on over a considerable portion of these tracts. By that I mean that settlers may manage to make a living upon them. I do not believe that any of them will ever become as well-to-do as the settlers on the adjacent hardwood lands have good reasons to expect.

Next to the interests of the settlers themselves, the people to be considered are the business men in the towns. In fact, these form really the most important element, and whatever they approve of is likely to be advocated by the representatives of these districts in legislative bodies. Now this class of men cannot expect to derive much prosperity from the farmers established on the former Pine lands, because their ability to buy will always be small. On the other hand, if the denuded tracts were devoted to the regrowth of construction timber, they would derive practically no revenue from these lands for a period of seventy or eighty years. But if these tracts were used for raising timber with short rotation, it would be possible to make them the basis of a permanent industry in manufacturing various kinds of woodenware, packages, boxes and the like. These factories would employ large numbers of men, larger numbers proportionately than the present lumber industry, with good ability to purchase, and therefore be the very best basis for the prosperity of the business people of the towns.

Of course, it does not follow that the short rotation management would be the most profitable for the owners of these lands. It is altogether likely that within the next decade, with improved fire and tax laws, some of the lumber companies owning such lands will find it profitable to raise thereon Pine with long rotations for construction lumber. This is particularly true of those large concerns who are able to employ the greater part of their capital in cutting Southern Pine during the long interval when their Northern second growth is maturing.

But such a condition will not be brought about unless the laws regarding fire and taxes are changed so as to treat the lumber concerns fairly and give them protection. Such laws, furthermore, cannot be hoped for unless the people of the locality can see their own direct advantage in maintaining forests. It follows that any future public management of forests in the Great Lakes region must, for some time to come, devote itself principally to the production of short-rotation material. This observation is intended to apply especially to those tracts stocked with soft woods. As to hardwood material, the original supply is still so far from being used up that questions of future restocking need not yet be discussed.

It is important to keep these principles in mind so as to be able to overcome reasonable objections to laws looking toward permanent maintenance of forests of large extent in the Great Lakes region. Incidentally they illustrate the point that the wisest forest policy is not always identical with the most rational management by the propietor who looks only to the financial return.

ERNEST BRUNCKEN.

Relation of Forestry to Commerce.

The necessity for the preservation of the trees of the forests, to insure the protection of the rivers and streams of the state, and the maintenance of waterways for commerce, was emphasized strongly in a recent speech in Utica, N. Y., by Hon. David McClure. The speaker, who was a member of the Constitutional Convention of 1894, related the enactments of that convention for the protection of the forests, which was the most important question before that convention, he believed, since the life of the canals depended upon the protection of the streams which fed them.

Mr. McClure advised that the creation of a single-headed commission for the care of the forests should be urged.

Sheep Grazing in Arizona.

Second Paper on the Statement that Forest Reserves are Injured by Grazing.

AFFIRMATIVE VIEWS OF A RESIDENT.

[THE FORESTER assumes no responsibility for views expressed in signed communications. The opposite view on this question was published in the October issue.—ED.]

It is almost impossible to overestimate the value of the forests in Central Arizona, that is the Black Mesa and San Francisco Mountain Reserves, in reference to the preservation of the water supply of the Salt River and Gila Valleys. The drainage of these two Reserves through their numerous tributaries is, to wit., Hell's Cañon, Sycamore Cañon, Johnson's Cañon, Ash Fork Creek, Oak Creek, Beaver Creek, Clear Creek and Pine Creek and numerous other tributaries or "feeders" rising on this high plateau, which composes the Black Mesa and San Francisco Mountain Reserves, and flowing into the Verda and Salt Rivers and thence on directly to the country around Phœnix. They are the highest forest areas of the whole Territory, and from their extreme height, some six to eight thousand feet, and parts as high as ten and twelve thousand, and the large and almost unbroken forests which cover them, they present in themselves ideal conditions for catching and condensing the clouds and precipitating the moisture upon these high tablelands.

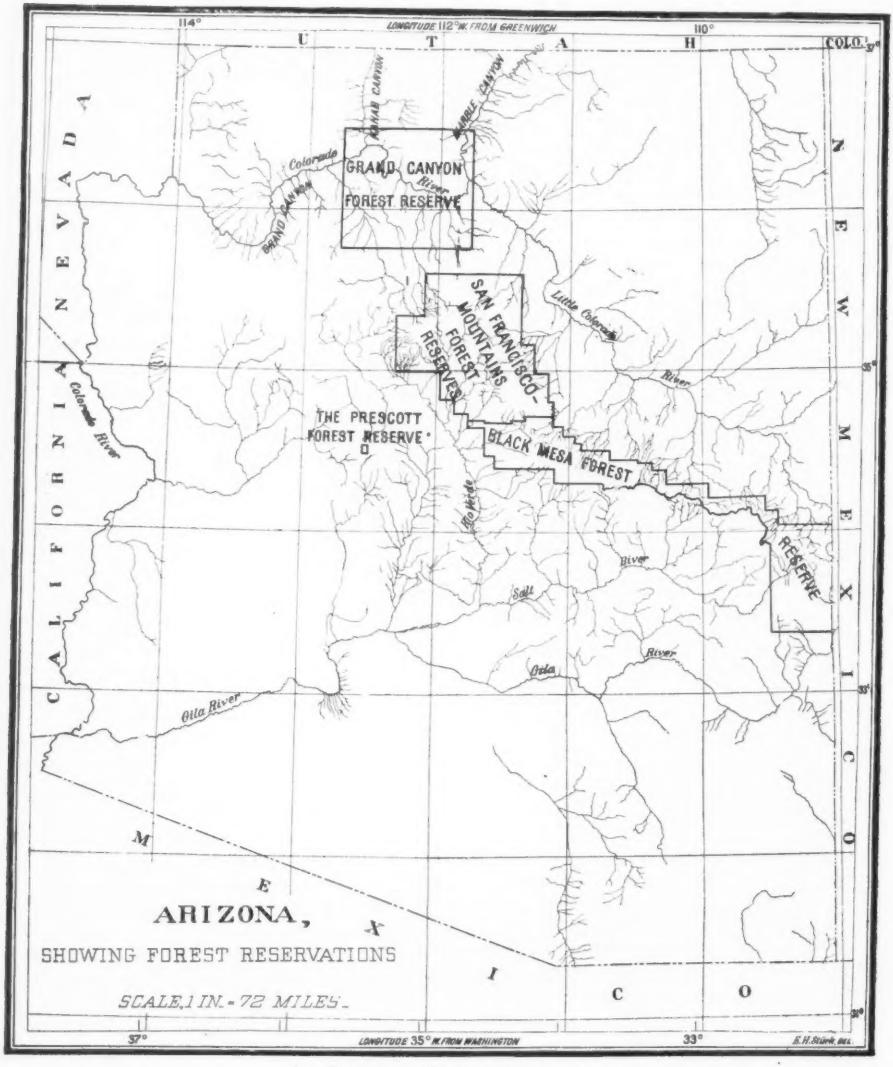
The effect of sheep grazing in large bands under the herding system, to any intelligent person, who has ever observed the same carefully, cannot fail to be pernicious in many ways. Large bands of sheep passing through these forests bruise and stunt, and very often break down, the young Pines. In passing by on the cars of the Santa Fe, just near the town of Williams, in an enclosed graveyard the young trees look exceedingly thrifty and beautiful, while on the outside or the public grazing grounds, there are scarcely any small trees living, and those that are to be found are stunted and broken and show plainly the effects of the trampling of stock. No unprejudiced person can pass by and see the contrast between the trees in the inclosure and the poor, broken, withered and small trees on the public grazing ground without being forcibly struck with the difference.

The sheep in the above named reservations are herded in large bands (from eighteen hundred to twenty-four hundred in a band), by an ignorant Mexican herder and his dog. He carries on his borro his entire outfit, consisting of scanty bedding, rations for two or three days and his cooking utensils. Three times each day—morning, noon and night—he builds a fire to prepare his meals, and he has very little regard as to what becomes of the fire after it is once built; for soon he has packed up his cooking utensils and other belongings on his borro and is off with his sheep again.

For several months during the year, especially in the Winter and Spring (the latter part of the Winter and through the Spring and Fall), these high elevations are constantly swept by strong winds, and at those times, as there is very little rain, everything is exceedingly dry and inflammable. Now consider that there are three hundred thousand sheep, and one herder to every two thousand kindling his fire three times each day, and you can form some idea of the impossibility almost, under such circumstances, to prevent forest fires. The owners of these sheep, in most cases, cannot see more than one or two bands each day, and in that way it is impossible for them to give this matter of forest fires very careful and close attention.

In regard to the fact that the streams are fed by the springs down in the cañons, that in itself shows to any thoughtful person the greatest necessity for protecting the forest cover and supplying as much shade, in the way of trees, as possible to

prevent the springs from drying up or largely diminishing in their flow. It is a fact that is well known, and about which there can be no controversy, that, in the early settlement of the Atlantic States, many streams, and even creeks, that were clear and deep and in whose channels flowed large volumes of water, from the denudation of the timber from the adjoining hills and valleys, directly ceased to flow, or flowed only at long intervals during the rainy seasons, after the land was cleared up and the settlements became thick.



AN OFFICIAL MAP OF ARIZONA.

The silting of the canals in the Salt River Valley from large bands of sheep, which summer upon these mountains and upon the reserves in Central Arizona, going from the reserves across to the watersheds of the streams and around in the vicinity of the canals of the Salt River, is something that one, who is acquainted with the effects of sheep-grazing upon the land, would be compelled to notice, on account of their pulverizing the soil in their course. The loose porous soil is then drifted by the high winds or washed by the rains of Winter and Summer into the canals, rapidly filling them up. In the San Francisco and Black Mesa reserves the Government has land naturally suitable for forest growing, and if the proper care be taken there will always be timber growing up as the matured timber is consumed by the increasing population, and water flowing from these natural reservoirs, prepared by infinite wisdom, through all time to beautify and enrich a great and noble State.

Yours truly,

(Signed.) ROBERT PERRINE.

Williams, Arizona.

Forest Fires.

California.

The picturesque slope of Mount Tamalpais, opposite San Francisco, was the scene, the middle of October, of a forest fire which destroyed several suburban villages near Mill Valley and burned Live Oak and Redwood forests. The rain finally extinguished the flames which a small army of fire fighters had struggled with ineffectually for several days.

In the Santa Cruz Mountains forest fires also did much damage, burning over a country dotted with small fruit farms and vineyards. The lack of water after a long dry season prevented successful resistance to the fires, but in one case 40,000 gallons of newly-made wine were used as an extinguisher. The wine was pumped from the vats and then forced through pipes upon the flames.

Another fire in the thriving, artificially-planted forest of the late Adolph Sutro was extinguished by the San Francisco Fire Department after sixty acres of Eucalyptus, Pine and other trees had been damaged.

Pennsylvania.

Destructive forest fires raged on the Allegheny Mountains, and many thousand dollars' worth of timber were reported destroyed.

After two days of hard fighting the fire warden of Union Township, assisted by a large number of men, succeeded in subduing the flames on the E. & G. Brooke Iron Company's woodland, on Round Hill. About 500 acres were burned over.

A press report from Altoona says that during the last week in October "more actual damage was done in that section than five figures could represent." The loss to owners of standing timber, fences, bridges, telegraph poles, and barns is estimated at $100,000 in Blair, Cambria, Clearfield, and Center Counties. In previous years the woods have been kept more or less damp by the Fall rains, but this season the forests are dry as tinder, after six weeks without rain. The resinous smoke from the fires causes inconvenience even to the townspeople.

Texas.

Forest fires were reported in Hardin County, Texas, in the beginning of October, "not a vestige of grass being left here, and no rain to amount to anything since July 2."

In the same State occurred other extensive fires between Wallisville and Turtle bayou, with considerable damage. There is much "Loblolly" Pine in this section.

Advices from Houston tell of daily damage in the counties of Chambers, Tyler, Hardin, San Jacinto and Polk, a section ordinarily a good grazing country, but now suffering from extreme drought.

West Virginia.

From all along the West Virginia Central Railroad come reports of great damage. Many farmers about Bayard, W. Va., have lost all their hay and corn, others their barns and crops, having been ignited by sparks from the surrounding forest fire. The mountains around Bayard are ablaze, and the town is without fire protection.

A trainload of water was sent out by a lumber company, whose log and truck men are fighting the flames.—October 28.

Maryland.

Thousands of men are fighting forest fires all through the Alleghenies. The mountains are reported to be one mass of flame all the way from Oakland to Grafton. Timber in the Flintstone and Town Creek section is reported burning, and the loss will be heavy.—October 27.

Forest Protection.

Protecting the Public Domain.

President McKinley, on October 21, issued a proclamation changing and enlarging the boundaries of the Prescott Forest Reserve in the Territory of Arizona. The reserve, which originally contained 10,240 acres, now embraces about 423,680 acres.

The reserving of this additional area has been necessitated by the reported urgent need for withdrawing these forested lands from the operation of the Act of June 3, 1878, under which they were being rapidly subjected to wholesale spoliation in the interest of large mining corporations operating some distance therefrom.

The Santa Yñez Forest Reserve, in the State of California, has been created by a proclamation dated October 2. The total area is about 145,000 acres.

The region set apart is traversed by the Santa Yñez mountain range, and lies north of the private land claims bordering on the coast and south of the private land claims bordering on the Pine Mountain and Zaca Lake Forest Reserve.

On Congressional Recognition.

William J. Nisbet, of the Indian Forest Service, one of the greatest authorities in the world on sylviculture, declares the United Kingdom could save the $50,000,000 now paid annually for foreign timber by giving proper attention to the reforestation of absolutely waste lands in Great Britain and Ireland. "Every penny of that vast sum," he says, "could be saved, besides giving healthy and remunerative employment to thousands of people." If this is possible in Great Britain, how much greater are the possibilities of practical results in this country. Forestry is a subject which should be no longer slighted by Congress.—*Phila. Item.*

A Fair Prophecy.

Despite the official reports that the forests of Michigan, Wisconsin and Minnesota are nearly exhausted, announcement is made that an army of 35,000 men will be engaged in cutting down Pine trees in that region during the coming winter.

It is evident that the call for forest preservation has been made none too soon. Unless the lumbermen are speedily checked, the water supply of the great lakes may be endangered. Already navigation is difficult in some of the connecting channels and there is talk of building a dam across the Niagara river at Buffalo to raise the levels.

When the forests have been laid waste there will be loud lamentations in the lake towns, though now they view the situation with apparent complacency.—*Utica (N. Y.) Press.*

An Important Decision.

A matter of very great interest to citizens generally has been decided by the Illinois Supreme Court, which has

ruled that the shade trees in the street in front of a man's property belong to him, and cannot be cut down or mutilated without his consent.

The suit was one in which a property owner sued a telephone company for cutting off the limbs of his trees in order to make room for its wires. The decision is prima facie evidence that the value of trees is becoming more generally recognized everywhere and augurs well for greater public interest in forestry itself. There can be no doubt that were the general public more fully aware of the principles of forestry, there would be manifested a very pronounced sentiment for the protection of trees, both in the cities and forests.

In the Woods of Minnesota.

Trip of a German Forest Expert Over the Site of the Proposed National Park. Some Considerations Indicating Large Profits to the State from Small Expenditure.

BY THE FORESTER OF THE VANDERBILT FOREST, BILTMORE, N. C.

The map tells us that Leech Lake's shoreline extends over 574 miles. The state of Minnesota, measured from north to south, is only 384 miles long. Imagine! If the shoreline, with all its bays and beaches and spurs and tongues, was stretched lengthways through Minnesota it would reach way down into Iowa! But shorelines do not belong to the chapter of economics.

Safely landed, with the help of an Indian pilot, we enter the woods. As usual, a belt of low hardwoods, Oaks, Elms, Maples, Birches and so on, occupies a narrow strip of land along the water-front. Nature has selected the fittest. Storms blowing across the lake with unbroken force are sure to turn over any Pines that might boldly show their heads beyond the level of the hardwood crowns. The long body of the Pine is a capital lever for the wind, with the help of which a tree is easily uprooted. The shallow root system of the White Pine subjects it badly to the storm's deadly attacks.

A look at the big hole caused by the wind tearing out a tree by its roots allows us to judge the quality of the soil. It consists of sand, with a slight admixture of loam, a soil which abroad, where the population is dense, is considered good for farming. No wonder, then, that the immigrant-settler is easily induced to occupy such and similar ground, offered to him by Uncle Sam's kindness free of charge, or at a low price by speculators who secure from lumbermen, at a nominal sum, large tracts, denuded of tree growth.

We see such land advertised in the papers as "the bonanza of Minnesota," "the poor man's paradise," "the Cripple Creek of the farmer." But woe to the inexperienced new-comer, trapped by these eulogies! To bring the ground in tillable condition is expensive, while the growth of potatoes, corn or cereals will exhaust the soil thoroughly in five years.

There is so much good land available in the United States that it does not pay to occupy medium land cleared from its cover of trees, even if it is given to the farmer free of charge. The federal and state governments have allowed, in the state of Minnesota alone, an area of several million acres to be transformed into an unproductive waste. The main principle of political economy, that the productiveness of every acre of national soil must be maintained or increased, has been overlooked. If the production of meat and hides pays best on a given soil, let us use it for cattle pasture. Where field crops are most remunerative, let us raise them. On land which is so rocky or so sandy as to bear

tree growth only, let us raise trees, and that kind and size of trees which pay best.

A look at the Pine woods surrounding us on Leech Lake tells us in a moment how trees should be raised. At the foot of their mother-trees we find millions of small Pine seedlings trailing on the ground. Where a windfall has removed the parent trees, the children at once shoot ahead towards the sky, growing at the rate of twenty inches per year. Why should we not imitate the wind, cutting all such old trees which have reached merchantable size and allowing their progeny of seedlings to fill the gap! This natural system of working a forest will allow ground fit only for tree-growth to continue to be productive after the virgin timber has been removed. If Nature herself were not sure to restore young trees in the place of the old ones, there would not be any forests on this globe. Imitating nature's ways, it is easy to maintain forests.

Why, now, does the timber owner allow the ground to be barren? Why does he give it up to the state for non-payment of taxes after cutting the old trees? Does he not realize that sapling trees thirty years old are worth twenty-five cents apiece, if the value of trees 120 years old is $2, figuring at three per cent. compound interest? Does he not see that skillful handling of the ax when removing old trees can result in 500 saplings per acre, which will grow up into timber of superior quality standing close together and clearing one another from side branches?

The timber owner is well aware of all these natural facts. But he is aware, too, of another not natural fact: The absolute certainty of the second growth to fall a prey to fires before it has time to fortify itself against conflagration by forming a heavy layer of fire-proof bark around its stump. In the case of the flat-rooted White Pine, even old trees, having their long roots imbedded in combustile mould, are badly subject to death from fires. The owner is undoubtedly wise, when leaving the land bare and barren.

But is the commonwealth wise in allowing the area of barren land to increase annually, in Minnesota alone, 125,000 acres? Should it not either employ a staff of guards to prevent fires on private land after lumbering, or else establish as a national forest and keep under proper care all such land as is fit for growing trees, and for nothing else?

We, the public, ruling and loving this country, must select through our legislatures that way which is best adapted to our peculiar economic and legal conditions. For our legislators, a knowledge of the facts prevailing in northern Minnesota, Michigan and Wisconsin is indispensable, if they want to solve the difficult problem. Col. John S. Cooper's excursion, starting from Chicago on September 28th, affords a chance to see the actual conditions. The facts form the argument upon which the urgently needed change of Governmental land policy must be based.

Two trains, consisting of thirty cars each, loaded high with 110,000 feet board measure of pine logs, passed the depot while the tourists were awaiting their train. Six freights of that description pass Walker day by day, each one carrying to the mills what the last 150 years have produced on an area of twelve acres. There is not one, but hundreds of logging camps in the woods, and we might well be proud of the achievements of American genius in forest utilization. We do business on a larger scale than all Europe taken together. Minnesota alone produces 1,250,000,000 feet of lumber annually, and it might continue to do so if 10,000,000 acres of pine land were treated after conservative principles.

A short ride through interesting forests and swamps takes us over to Cass Lake. The white man has not had a chance yet to ruin the beauty of the Chippewa reserve. Instigated by the dead-and-down timber act, he has tried, of course, to put his hand on its chief value, the timber. As there was not enough dead-and-down timber to make logging remunerative, he has worked hard with kerosene and firebrand to accelerate the death rate of trees. Charred Pine trees on hundreds of acres bear witness to the deed.

There cannot be any doubt that on good land the farmer's plow must follow the

lumberman's ax. On medium and poor land, however, the tree must be followed by the tree, lest the national soil be allowed to lie unproductive. We hear a great deal of talk relative to reclaiming barren soil for production by means of irrigation. Why does no one lift his voice with a view of preventing productive lands from being changed into a barren waste?

Reforestation of absolutely denuded tracts is difficult and expensive. France and Switzerland are spending millions of francs annually to restore the forest on tracts wherefrom reckless use removed it decades ago. We learn abroad how to do this and that. There are a few things which we should learn not to do. Forest destruction is one of them.

Forests and swamps are nature's storage basins. If we destroy them agriculture and commerce must suffer. Suppose the advantage annually derived from the mere existence of forests, owing to their influence on water supply, public health, commerce and manufacture amounts to a million dollars. Should we not spend $200,000 annually for the maintenance of forests? We maintain an army, a navy, an administration, a foreign service. Should we not employ local police, organized after the army pattern, to guard the forests on our private, state and federal land? Germany and France have a forest service. Why not we?

The "Forest Soldier."

After some slight training the "forest soldier" might be employed for laying out and keeping in order public roads traversing the forest. The importance of roads to transport forest produce and for firebreaks will make it advisable to put road matters in charge of the foresters. The revenue derivable from sale of forest produce will soon be sufficient to more than cover all expenses.

The American people have seen their way clear in many a case. If they only were aware of the facts they would soon find a broad highway out of the difficulty. This is an economic question, and on better business men than the American people the sun never shown.

The facts are plain enough; millions of acres in Minnesota, Wisconsin, Michigan and elsewhere, productive of timber, have laid idle for years. Private enterprise cannot transform the waste into productive land, the transformation not having proved to be remunerative under the present economic conditions. Change the conditions! We not only complain of the non-production of 150 feet board measure per acre per annum on the deserted land. Every 150 feet board measure produced means employment of common labor in manufacturing hundreds of commodities out of wood fiber—furniture, etc. The labor required to transform 150 feet board measure into some sort of a manufactured product averages about $3. If 50,000,000 acres fit for timber growth are lying idle, $150,000,000 are lost annually to the American laborer in the near future.

Bewildered at our own conclusions we stop—just in time—to see at our feet the foot-prints of deer—long, pointed, a narrow bench left between the hoofs, the hind hoofs slightly impressed in the wet soil. This is a stag's calling-card, and a big animal he was. Game is getting scarce, losing its abode in the vanishing forests. Large forests cannot and shall not be kept for sport and fun only. But if sport and fun can be had in addition to economic use, why not have them? Constant use makes the instrument dull, and even sharp American wits will require filing now and then.

The White Pine, being exacting, requires nourishment and help to propagate its family. Often a generation of Poplars and Birches must act as nurses for the much-exacting aristocrats. The old tree, on the other hand, although it sends its roots over a space of 600 square feet, embracing rocks and dead stumps with root fibers, is readily killed by heavy fires. No wonder, then, that the lumbermen, instead of leaving this sensitive treasure in the forest, prefer to transform it into fire-proof money at the quickest possible rate.

If you have not seen those giants of the woods, overtowering their neighbors by sixty feet, go quickly, before they all dis-

appear. Even if the country adopts a system of forestry, such giants will not be produced any more. They are losing rather than gaining in volume and value. Now 300 years old, they have not added more than two per cent. annually to their volume for the last 150 years. Soon they will fall and decay. On the dead body, nature will plant the most beautiful velvet of tender mosses, decorating the old giant's grave. And after a while, amongst the mosses a seed will germinate, developing into a White Pine. The young generation builds up its new organism on that made by its ancestors, just as human beings continue business footing on their fathers' work.

There is no room in the dictionary for all our names: all we can secure to last longer than our life is a good name and memory, cherished by loving children.

C. ALWIN SCHENCK.

Dispelling an Illusion.

The fear of some citizens of Minnesota that the creation of a great National Park and Forest Reservation in that State would interfere with their material prosperity has been dispelled in large part by a consideration of the business and population in the Adirondack Park in New York. In a recent letter in reply to inquiries addressed to him by the Chief (Forest) Fire Warden of Minnesota, Colonel William F. Fox, Superintendent of State Forests of New York, says:

GENERAL C. C. ANDREWS,
St. Paul, Minn.

MY DEAR SIR:—I take pleasure in acknowledging the receipt of your letter of the 3d, and would respectfully submit the following information in reply to your inquiries. According to the State Census of 1892, there was a population of 32,071 within the boundaries of the great forest of Northern New York, or what is termed the Adirondack Park. This population has increased largely since the census was taken, it having doubled in some localities. The figures given embrace permanent residents only, and do not include the very large number of hotel people and tourists who frequent the forests during the Summer season. There are *also* a great many sportsmen who go into the woods during the Spring months to enjoy the fishing, also the hunters who go there in the Fall for the deer and partridge shooting.

Of late years the fixed or winter population throughout the Adirondacks have become strong advocates of forest preservation. They admit freely that they can make more money out of the Summer people, tourists and sportsmen who frequent the forests than they can obtain from the lumbermen. There are over 1,000 guides in the Adirondacks. In the Annual Report of the Forest Commission for 1893 I published the names and postoffice addresses of 788 of these guides. When these men work for the lumbermen they receive $1.00 per day and board. During the Spring, Summer and Fall, while employed as guides, they receive $3.00 per day with board and other expenses. The livelihood of these men and provision for their families depends upon the existence of the forests.

In further reply to your inquiries I would say that the population of the Adirondack forest is more largely scattered than the figures given you would indicate. There is little tendency to concentrate in villages. Still, there are several villages which are entirely dependent upon the people who come to the woods for pleasure or health. The village of Saranac Lake contains about 2,200 people. This place is built up largely by wealthy persons who, on account of pulmonary troubles, are obliged to live in the forests. Lake Placid, with a population of about 1,500, is composed almost entirely of hotels and boarding houses. In the Summer it has a population of several thousand. These people do not want any lumbering done

near them. There is more money for them in a standing forest than in saw mills and river driving. They would rather see the logs standing in the trees than in piles in the skidways. The villages of Wells, Indian Lake and Long Lake have each a population of from 700 to 900 people, one-half of whom obtain their livelihood by work as guides.

In the Catskill forests there are several beautiful villages, notably Pine Hills, Tannersville, Palenville, Hunter, Stamford, Margaretville and Fleischmans, with a population of from 800 to 1,200 each. These villages are all dependent for their existence upon the Summer residents, who throng this region on account of its nearness to New York City; but the villagers are well aware that if the forests which cover the Catskill Mountains are ever removed or destroyed they will lose the patronage of the Summer people and their occupation will be gone. Of the many thousands who frequent our Adirondack and Catskill forests each Summer a good proportion are from outside States. The large amount of money which these outsiders leave within the State of New York will exceed the millions which the State is paying for the purchase and preservation of its forests.

Hoping and trusting that the forest movement in your State will be successful in every way, I am

Yours with great respect,

WILLIAM F. FOX,
Superintendent State Forests.

For the Majesty of the Forest.

A young and prosperous nation is necessarily unthinking, so far as the consideration of posterity is concerned. But with nations as with individuals, age is inevitable, and may we have the good sense to profit by the experience of some older countries in a matter of beauty and utility, an tinicipation of an age that will surely come. As the years roll on and each succeeding generation continues to ignore its duty and to set aside all obligation to retain the beautiful in age, our country will soon be deprived of one of its greatest glories—its primeval forests. It is nature and the gods alone who are eternally young. "For there is hope of a tree if it be cut down, that it will sprout again." Nature is kind to her children and in spite of the many wounds inflicted upon her motherly breast by the greed and thoughtlessness of man, she is ever prompt to heal the wounds and lend her care to the new life intrusted to her keeping.

Happily the time has come when the attention of our people is being called to this important subject through the efforts of the American Forestry Association. To the majority of persons, the word forestry suggests a vague idea of planting trees and beautifying generally, when in reality this is but a branch of the subject. "Forestry is simply the management of lands grown with forests, and its object is to derive from such lands the greatest possible benefit for the owner."

Forestry does not necessitate the appropriation of good agricultural lands; one of its greatest advantages is that wood and timber can be profitably grown on soil that is unfit for farming purposes. Germany discovered this some centuries ago, and a system of forest schools was established which has led to the grand results seen there to-day. Nor does forestry interfere with the march of civilization, nor the growth of cities. The Black Forest is an illustration of this.

The forests of Germany are its crowning beauty as well as the source of health, wealth, and national independence. And perhaps there is not a nation in the world that has paid more attention to the study and application of the beautiful in forestry and arboriculture than Japan. The Japanese make the most of every inch of ground, and take care to plant Firs and

Cypresses in barren soils that are fit for nothing else. For ornament and shade, however, the roads are lined on both sides with superb Pine trees, which give great beauty to the country and make travelling in warm weather a pleasure. And we, too, are lying the foundation for a like record in the years to come.

The United States has recently set apart 46,000,000 acres of mountain lands as a forest reserve, and has appointed a sufficient force to insure their administration and protection from fire. It is an interesting fact, that for the first time in the history of our country, the President in his last annual message, devoted space to the subject of forestry.

We have much to look forward to from the increasing interest manifested in our National and State Parks, and in the conscientious efforts of the officers of the Association to enforce the laws in punishment of wilful destruction and for the still more disastrous results arising from carelessness in starting forest and prairie fires. The fire wardens in our State have done much to stop this evil, and the report for 1898 shows, of the total number of fires, 78 per cent. controlled or extinguished by fire wardens.

The States of New York and Pennsylvania have made more progress in a business-like treatment of forestry than any others in the Union. Pennsylvania sets the valuable example of being willing to sink large amounts of money without hope of return, simply because she appreciates the immense indirect advantage to be derived from a proper care of her forests. And let us hope that the people of Minnesota may be equally far-seeing, and may not withhold their hearty coöperation and substantial aid in furthering the work so well begun.

REBECCA B. FLANDRAU.

In the *Courant*, St. Paul.

The Forests of the Nation.

The annual report of the Commissioner of the General Land Office of the Department of the Interior, which will shortly be issued, contains the following recommendations referring especially to forestry:

The changing and enlarging of the limits of the Mount Ranier National Park, State of Washington, on the lines advised by Bailey Willis, of the United States Geological Survey, in his article, prepared especially for THE FORESTER, and published in the May issue of this year.

The extension of the Yellowstone National Park.

The appropriation of three hundred thousand dollars for the expenses of the forest service in connection with the creation and administration of forest reservations.

The enactment of a law that shall empower forest officers, special agents, and other officers having authority in relation to the protection of public lands and the timber thereon, to make arrests, without process in hand, for the violation of the laws or rules and regulations relating to the forest reserves or other forest lands of the United States.

The authority to rent or lease lands within forest reservations for any purposes not incompatible with the purposes for which such reservations are created.

Legislative provision for the entry of lands within forest reservations which are found to be more valuable for the coal therein than for forest uses.

Protecting the Government in the exchange of lands within forest reservations for those without, by legislative provision that the natural state of the tract relinquished shall not have been changed except to such an extent as may have been necessary in clearing the land for actual cultivation.

Recommendation in matter of perfected claims to lands in forest reserves (Act June 4, 1897), where ownership is established and land is reconveyed to the United States.

THE FORESTER.

A MONTHLY MAGAZINE

Devoted to Arboriculture and Forestry, the Care and Use of Forests and Forest Trees, and Related Subjects.

ANNOUNCEMENT.

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SPECIAL ANNOUNCEMENT.

The next issue of THE FORESTER will be the Christmas number. It is the intention of the editor to make it noteworthy in a number of ways. There will be more of the new features which have marked the recent progress of the magazine, and which have received the warm commendation of its readers. Its contents will be even more diversified than usual.

THE FORESTER during the year 1899 has aimed to commend itself on its own merits to all who should look through its pages. If the editor may judge from letters written by its readers, it has improved in quality as well as in size and appearance, and it is confidently believed that the Christmas issue will be voted the best and most attractive number of a good volume.

But this end has not been reached without increased expenditures of a very considerable sort, cheerfully authorized in the firm belief that the improved magazine would be more welcome than ever to its old friends, through whose help, linked with the efforts of the management, THE FORESTER would reach many new subscribers. And in the consummation of this plan every friend of forestry can do yeoman's service.

"Rally 'round the tree" is the watch word, a little energy and personal influence the requisites. Public interest in forestry is everywhere increasing rapidly, in proportion as its importance becomes known. To bring the subject forward, THE FORESTER makes the following offer: To all who subscribe during the present month will be sent THE FORESTER up to January 1, 1901, with the issues of the last three months of this year, including the handsome Christmas number—fifteen months for $1.00.

Attention is also asked to the blank application for membership in The American Forestry Association, to be found on the page facing page 270 of this issue. Let each member have this filled in and returned by a prospective new member. All applications come before the committee on membership for ratification. New members whose annual dues are paid during the current month will be furnished the above mentioned copies of THE FORESTER gratis. Duplicate blanks with any further information may be secured by addressing The American Forestry Association, Washington, D. C.

There are many evidences of a public awakening throughout the United States to the realization that the perpetuation of forests is a matter directly affecting the welfare of state and nation. There can be no denying the fact that the attention of thoughtful people has been much aroused lately to the importance of the subject.

The prospect of a great National Park in northern Minnesota has stimulated other parts of the country to action. In a letter to THE FORESTER, a member of the American Forestry Association says of this movement:

"Western North Carolina, it seems to us here, is par excellence the place for a National Park. Thousands upon thousands of acres of virgin forest, at an altitude ranging from 2,000 to 6,000 feet, are now inviting such a beneficent movement. Apart from the Vanderbilt forest of nearly 100,000 acres, the woodman's ax is fast getting in its work in this most beautiful mountain section of America, and a few years from now the opportunity of establishing a National Park here may be lost. Senator J. D. Pritchard, a man of ability and influence, is interesting himself in the project and I bespeak for the enterprise your coöperation."

CHIPS AND CLIPS.

Autumn tree-planting gives emphasis to the growing interest in forestry.

The forests which have wood "to burn," as the colloquial phrase goes, justify their name at this season of the year by frequent fires.

One million people are supported by forestry in Germany and two millions more by manufactures of which forest products form the principal material.

The steady advance in prices in the lumber trade was brought to mind rather forcibly by a pack of Chicago thieves who recently stole 60 feet of a picket fence.

A feature of the forests of British Columbia, especially of the coast, is their density. As much as 500,000 feet of lumber has been taken from a single acre.

Cornelius W. Smith, of Syracuse, N. Y., president of the New York State Fish, Game and Forest League, died at his home of heart disease, October 28, aged 54 years.

The municipal authorities of Camden, N. J., have prohibited the further posting of handbills and advertisements on trees in the public streets on account of damage done to the trees.

A series of tests, to determine the strength of British Columbia Douglas Fir produced very satisfactory results regarding the relative value of the various qualities submitted.

Elihu Stewart, Canadian Chief Inspector of Timber and Forestry, made an official trip through Manitoba and British Columbia lately to investigate the condition of the forests of Western Canada.

The local authorities in Ulster County, N. Y., are securing options on 9,000 acres of wild lands for forest reserve purposes, under a legislative act appropriating $50,000 for purchasing lands in the Catskills.

Pacific Coast lumbermen expect that Russia, with her trans-Siberian railway, the development of seaport facilities and the establishment of commerce on the Pacific will prove a valuable customer in the near future.

Pennsylvania seems to be experiencing a considerable awakening to the good which Commissioner Rothrock can accomplish if provided with the necessary means. But the State Treasury has no funds for forestry at present.

In Europe there are a number of good examples of remunerative forestry. The duchy of Baden derives a net annual revenue of $667,000 from 240,000 acres of public forest, and the kingdom of Wurtemburg $1,700,000 from its 418,000 acres of public forest.

The White Spruce is a very useful timber, grows in low swampy lands, and does not occur in large compact bodies, but interspersed among Fir and other trees. It almost equals the Fir in circumference, but does not grow to such a height nor is its stem so clear of branches.

Japan is taking kindly to the principles of forestry, the government now making provision for perpetuating the forests on a definite plan. In the main islands the forest cover has been considerably denuded, and an imperial edict has decreed that young trees shall be planted for every mature tree cut down.

The city of Santa Barbara, Cal., has consummated the purchase of 3,500 acres of mountain lands in the Santa Yñez range, in accordance with an act of Congress allowing an option of $1.25 an acre, for purposes of water conservation. A tunnel will be built to Santa Yñez River, a distance of three and a half miles, to supply the water.

Nuts for Planting.

Gather the nuts (Walnuts, Hickory Nuts, Hazelnuts, pits of Peaches, etc.), place in a rough bag and bury in the garden about a foot deep. By the time the frost is well out of the ground in the spring the shells will have burst and the nuts can be placed in a bed especially prepared for them or put where the trees are to stand.

Wood-Paving in Parks.

British aristocracy objects, quite rightly enough, to being jolted and jarred over a badly-kept macadam road whenever there is an occasion like the Queen's Drawing Room to take them to Buckingham Castle. With the exhaustion of patience, their demands have secured the adoption of wood-paving for the Mall, insuring a smooth pavement directly to the palace. This is the first road in any of the parks to be ordered paved with wood.

The Tree-Surgeon's Work.

The care of individual trees in the city and suburban yards brings up the question of Autumn trimming. Limbs should be cut off slanting, never square on top, as is often done. The advice of Peter Van Vechten, of Milwaukee, Wis., is to preserve the wood from decay, after cutting, until the new bark and wood extends over it, by the application of gum shellac dissolved in alcohol. Paint is often used, but the shellac solution is declared to be better.

A Valuable Wood.

There are three varieties of Ebony of considerable commercial importance, all distinguished for their great density and dark color, uniform throughout. The darkest Ebony is from the Gaboon coast of Africa, the densest comes from Madagascar, while Macassar Ebony furnishes the largest pieces. All the varieties are heavier than water, imitations being discovered easily by their lighter weight. The real Ebony will not show the least deterioration from use.

As Others See Us.

Herr O. Von der Heyde, Assessor of Forestry of the German Empire, is making a scientific tour of America on his return homeward from an official investigation of the governmental management of forests in India, Japan and other oriental countries.

He praised the excellent systems in operation in the countries named, and declared the lack of a public demand for similar work in America would surely be found a costly mistake in a few years. He said the whole people ought to advocate governmental preservation of the forests, rather than allow their rapid denudation without thought of the future.

Philadelphia's Innovation.

Municipal tree-planting on a grand scale has been advocated by the Mayor of Philadelphia to transform the main street of Pennsylvania's greatest city into a shaded boulevard. Broad street is the longest paved street in the world, and in the absence of such city parkways as Commonwealth Avenue, Boston, it is planned to make this street a popular driveway through the heart of the city, just as the river drive in Fairmount Park compares favorably with the Riverside Drive in New York City.

The plan originated with Mayor Ashbridge, and has received the endorsement of the heads of the main municipal departments, and of many prominent citizens. The estimates have been prepared and it is desired that the work may be speedily undertaken and completed before next summer.

City Forester Lewis is in hearty accord with the plan and will supervise its being carried into effect. Regarding the beneficial results of the innovation he says: "Foliage, while not an essential, is always conducive to the health of a locality. Any section barren of trees must suffer from heat in the summer and gales in the winter, to say nothing of the known scientific fact that trees are a natural sanitary agent. I have always been in favor of shaded boulevards."

Plain Talk From Oregon.

Big forest fires are raging in the mountains surrounding the valley on the west. In the Cottonwood range, the fire is raging fiercely, and the valley is enveloped in thick smoke. So heavy is the smoke that the adjacent hills are scarcely distinguishable. Thousands of dollars' worth of fine timber is being devoured by the flames.

The *Examiner* would like to see somebody brought to terms for this criminal act—the act of a sneak and a poltroon, who believes he will not be detected. If the state of Oregon has any "pull" with the Interior Department, patrolmen should traverse the best timber belt in the great Northwest in quest of the unscrupulous villains who would disgrace the stripes of a prison convict.—*Lakeview Examiner.*

Recent Publications.

Forestry Investigations of the U. S. Dept. of Agriculture, 1877–1898.

REPORT BY B. E. FERNOW. HOUSE DOCUMENT, NO. 181.

In accordance with a provision of Congress, in an act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1899, the Secretary of Agriculture has had published "a detailed report * * * upon forestry investigations and work of the Department, * * * showing the results obtained and the practical utility of the investigations." The report has just appeared as House Document No. 181, 55th Congress, 3d Session, its author being the late Chief of the Division of Forestry, Dr. B. E. Fernow, now Director and Dean of the New York State College of Forestry.

No one is so well qualified to compose such a work as Dr. Fernow, who from the first has been identified with the active movement in the interest of forestry which has accomplished so much during the last twenty years, and has been one of its chief leaders.

For every one interested in forestry or forest resources, in the application of timber and wood to construction and manufacture, in any of the countless industries which depend directly or indirectly upon the tree supplies of this country, the report under review is filled with valuable material. Much of the technical portion of the work, relating to "timber physics," forest destruction, "American woods," the lesser forest industries, and other topics has appeared already in one or more of the publications of the Division, and consists of copies, extracts, and reprints therefrom. In addition to these more or less exhaustive discussions of various phases of the work of the Division, which serve as examples of that work and are its best justification, the report contains a great deal of important historical matter.

The origin of the Division and the causes which led to it, its effects upon public sentiment, its educational influences, its scientific contributions to forest literature, its pioneer research in many directions, and its marked impress upon State legislation and the Federal forest policy form the leading outlines of a most interesting chapter in the history of the last twenty years of our national life. Again, from another aspect, there is a helpful sketch of the growth of the Federal forest policy itself, with the long and arduous legislation from the first ineffectual Haldeman bill of 1872 to the present day; and yet again, there is a general account of the forest movement throughout the United States, a review of existing State Commissions, and a comparative exposition of the status of State forest legislation.

Dr. Fernow brings out a point or two that should not be forgotten. The epoch in forestry through which we have just passed, and which may be said to find its natural completion in the resignation of Dr. Fernow, is characterized in his own words as "the period of propaganda and primary education." Its ends were from very necessity, not permanent, but temporary: to open the eyes of the public, awaken sentiment, dispense knowledge, stir energy, commence the collection of data, and lay the first sure basis of technical research. The new epoch is that of example and coöperation in realizing the proper aims of forest management and tree culture.

The intelligent public all over the United States has become awakened to the need of better methods of handling both public and private forests. Reserves to the extent of about 46,000,000 acres await Federal utilization; separate States have established reservations and organized systems of protection against fire, and many private owners are striving to use conservative forest methods. The time has arrived when actual demonstrations of the principles of forestry are required, and these the Division is endeavoring to secure through coöperation with private owners to the extent of assisting them in handling their forest land. How much can be accomplished in this line will depend upon the action of Congress in allotting the appropriations.

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